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ABSTRACT

Based on the premise that there are major changes occurring in the programs and/or curricula in engineering schools of today, the author suggests that to focus on the potential of recycling as a natural vehicle would powerfully implement some of the trends in sight in an inventive engineering educational enterprise. His suggestions are given in such a way as to relate how at each of the undergraduate levels the students could get involved in design projects related to recycling or reuse. Examples of projects recently carried to successful status are cited. A second suggestion relates to the potential of recycling for giving interdisciplinary, industrial, and governmental dimensions to an engineering program. To illustrate this point, a description is given of a local recycling enterprise that was initiated. Its goals and purposes are stated. Future plans are suggested in relation to proposals of other such separation-based systems. The third potential explained is that of recycling with respect to giving social relevance to an engineering program indicating concerns for ecology and resource recovery and by coupling the recycling action with jobs or voluntary action. (Author/EB)

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RECYCLING AS AN EXERCISE IN ENGINEERING EDUCATION

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INTRODUCTION

A recent article in Machine Design titled Training Tomorrow's Engineers indicates several major trends in the programs and procedures currently being utilized in the schooling of engineers. Three of the most marked changes outlined were 1) the move "away from an engineering-science flavor toward an engineering-design emphasis" - the establishment of a design-oriented point of view, 2) increasing the dimensions, the breadth, of the program by "interfacing with other disciplines, graduate studies, general college curricula, and industry or government participants," and 3) perhaps the dominant recent trend, a stress upon the social relevance of engineering toward the development of "a new breed of engineer who is as sensitive to social, economic, and political forces as to technological ones." I'm certain I don't have to trace these shifts for attendees at an ASEE annual meeting, but do feel it can serve to focus on the potential of recycling as a natural vehicle to powerfully implement these desirable ends or goals in an inventive and worthy engineering educational enterprise.

I. First of all a look at the potential of recycling as an exercise with respect to an engineering design emphasis.

Possibly the best way to illustrate the value of recycling in the creative design area is to indicate, at various undergraduate levels, the kinds of experiences we have been involved with and you can use these to spark some related creative insights of your own.

Our first design experience comes to freshmen in a Communication and Design course in which they concern themselves with solo and team projects at the concept design level. From a group of four or five suggested problems, they select one for their personal project or they may suggest a problem from their own experience in the same general area for the instructor's approval. Following a structured problem-solving process, which involves the generation and evaluation of at least two alternative concepts, they select one concept through careful evaluation, refine it, and arrive at their very own problem "solution". This is at the "paper" level - really a form of feasibility study but nonetheless a most challenging exercise for a nervous novice in the soloing of open-ended, real life problems.

To relate our people to a vital societal concern, the dimensions of which they can readily identify from daily life, we have regularly suggested problems

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involved with separation based organizational or municipal recycling. Actual minimum cost recycling equipment which has been projected by freshmen has been:

a) A bottle-smasher - to make acceptable cullet (glass bits) from glass containers.

b) A can-flattener - label remover to render metal cans ready for recycling.

c) A device to slit tires to render them acceptable for burial in landfills.

d) A cardboard and paper bailer.

One of the key constraints applied to all the projects listed was minimum cost so as to occasion the innovative use of off-the-shelf or "junk" components in the designs. Future projects which we hope to suggest are:

a) A device to pulverize plastic containers.

b) A home recycling station

c) A device to allow rapid separation of the aluminum from the steel in bi-metallic cans.

d) Alternate re-uses for newspapers, cardboard and other household waste items for reinsertion in the resource stream as opposed to recycling.

Since architects (as well as engineers) are in our first class in Communication and Design we have also included several projects which are specifically set up to involve them in the design of systems and environments which have the concept of recyling relevant in the finished design such as a kitchen in which preparation for recovery and reuse is expeditiously provided.

For sophomores and juniors each school year we get involved in extra-curricular design projects which are actually carried to completion and presented to a student night sponsored by the local SAE chapter. Here the presentation and design are rated by practicising engineers. Once again projects related to recycling or reuse are an excellent and most natural option. Two devices recently carried to successful status in this category are:

a) A bottle smasher constructed from a 55 gallon drum, a used 1/3 horsepower washing machine motor, and angle iron which can be built for an out-of-the-pocket parts costs of around $30.00 and has an output capacity of about 15,000 pounds of cullet per hour. The plans of this device have been made available by Owens-Illinois, Inc. and shared with about 250 individuals and organizations throughout the U.S. and Canada.

b) A can smasher-flattener made from sand-filled wide-oval tires, front-wheel spindles, a one horsepower motor, and angle iron - also a high-capacity, low cost, component for day-to-day use in any recycling enterprise.

As can be intimated from a comparison of freshmen and sophomore-junior projects, we do indeed use the early feasibility study reports to form possible conceptual basis for the more advanced projects. This allows the freshmen students to relate to actual projects and see some of their ideas come to actual fruition, see some of the "best" concepts proved unworkable, and also allows a good head-start on projects which already are hampered by a tight time frame.

II. And now a look at the potential of recycling for giving interdisciplinary, industry, and governmental dimensions to an engineering program.

Once again it would seem that the best way to illustrate the value of recycling in this area is to indicate a few of our experiences here and allow you to piggy-back with your own brain-storm.

Following the development of our low-cost, high-capacity recycling devices (keyed by our choice to separation-based, "household" recycling) we sought to share these units and get them to work in an actual resource recovery operation. There are many options at this point - the one we selected was to initiate a local recycling enterprise, a non-profit corporation. To indicate its goals and purposes, here's a quote from the Articles of Incorporation:

1. To conduct research on, develop and test the feasibility of methods of recycling and reclaiming glass and metals.
2. To operate an experimental recycling project for glass and metals.
3. To provide employment and on-the-job training for Neighborhood Youth Corps workers of high school age.
4. To create a concern for humanity and ecology in the engineering and other professionals-in-training who are participating in the program.
5. To actively support inner-city religious projects through contributions of time and money.

The corporation, as actually set up, secured local professional people to staff its Board of Directors, and had no official ties with the college, but two of the directors, the working supervisors, and the "professionals-in-training" came from the school. In a whole host of ways such as getting the county's support with a paved operations site at their key landfill, securing the Neighborhood Youth Corps workers through the city Board of Education, and finding start-up funding from the city ($2500) and local industrial foundations ($5,000), the young people had to relate to industrial and governmental agencies - an excellent and broadening experience. In addition, having to relate and make common cause with other young people from other disciplines such as law, business and sociology was a worthwhile interdisciplinary encounter.

For the future, among other things, we are looking at a possible proposal to design a complete low-cost, separation-based recycling-reuse system for smaller municipalities (5,00 to 25,000 population) providing all the technology and consultation necessary to see it operational.

III. Finally let's probe the potential of recycling with respect to giving "social relevance" to an engineering program.

As before we'll trace a few of our experiences to trigger your own novel alternatives.

One can already sense from some of the material previously presented, how societal dimensions may, on two basic fronts, be incorporated in a recycling situation. Very naturally the concern for ecology and resource recovery so inherent in recycling is a most appropriate societal concern for today and tomorrow. Then too, by coupling the recycling action with jobs or voluntary action by a whole variety of people from industrialists to inner-city and handicapped young people, the "social relevance" factor becomes very real and immediate. At this point in time we have VISTA (domestic Peace Corp), CETA (Concentrated Employment Training Program), delinquent state wards, Neighborhood Youth Corps, and handicapped, sheltered workshop, young people working with us. Its all very exciting and, we must say, we never realized the potential of a simple technical-style project with respect to its people-dimensions.

We hope this has been helpful to indicate some interesting latent possibilities in projects tied to resource recovery. Truth of the matter is we need to make a whole generation aware of improved stewardship with respect to resources and relations to neighbors. A good place to begin is with the young engineers under our educational care.